Chapter 1
Possible Use of Water Areas by Disabled People

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Abstract People with reduced mobility have specific needs regarding their access to areas within the landscape. This follows not only from the findings of a questionnaire survey, but also from the experience with designing barrier-free buildings and their surroundings, where for example in the Czech Republic, it is necessary to respect Decree no. 398/2009, on general technical requirements for barrier-free use of buildings. This chapter presents the basic parameters for designing roads in the countryside as well as recreational areas and access roads to water bodies, view points, fishing places or just water. Stable banks need to be selected for access to water bodies. The bank stability can be enhanced by means of biotechnical modifications. Examples from Slovakia and the Czech Republic show that pleasant places accessible for all can be created also in the vicinity of water bodies if a universal design is used in which persons with reduced mobility are considered.

Keywords Wheelchair users · Surface · Fishing · Swimming
Trails for disabled people · Universal design

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1.1 Introduction

When creating a suitable barrier-free natural environment around water bodies or rivers (water areas), it is necessary to be acquainted with the requirements of people with reduced mobility as well as the parameters of their movement. People with reduced mobility are wheelchair users, persons with pushchairs and people accompanying children younger than three years, the elderly, pregnant women and persons with crutches, canes, walkers or other walking aids. People with physical disabilities form a large and very diverse group.

The situation is most difficult for wheelchair users, which is why this group was selected as the topic of this chapter.

The current trend is to discover new ways allowing people with physical disabilities to choose their own way of life and live without relying on the help of others, needing constantly to ask for aid, as much as possible. The basic prerequisite for somebody's active participation in social life is the accessibility of areas and buildings, and the ability to use them and move freely in them. This means the fulfilment of the right to freedom of movement in the broadest sense of the word (http://www.czp-msk.cz/pdf/uzitecne/ATHENA_PRIRUCKA_KOMPLET.pdf).

It is necessary to design not only paths and parking lots, but also access to water and hiking trails, meaning walking paths, bike paths or educational trails, in order to allow wheelchair users independent, safe, easy and smooth motion. Additionally, the wheelchair users need to be able to pass by other pedestrians or even bicycles in a natural environment. Routes already implemented abroad are good examples (Fig. 1.1).

However, the issue of passing by or conflicts with other pedestrians, skaters, but especially cyclists, needs to be addressed specifically. Discussions with wheelchair users have shown that this is a great problem for some of them. Some wheelchair users negatively evaluate the behaviour of cyclists on their shared trails. These trails

Fig. 1.1 Signpost directing the viewer to a rest area with a view of the scenery—adapted for wheelchair users—Scotland (*Photo* Fialová)

are thus dangerous for them. If the financial situation and the spatial arrangement allow, it is appropriate to propose separate paths for these two groups.

The issue of providing comparable conditions for recreation and its full use by people with reduced mobility has been dealt with abroad for a significantly longer time than in the Czech Republic. Some countries have created detailed methodological guides or recommendations which present the needs of these people and simple solutions to the satisfaction of their needs, so that people with reduced mobility can actively participate in recreation. The range of activities available is very varied. There are opportunities to go fishing, sailing, go into water and bathe, sit by the fire or use relaxation points. The measures that allow people with reduced mobility access to recreational activities are in fact usually very simple and are not demanding in terms of the material used. An example can be the guide by Ylva Lundell, a researcher from the Swedish University of Agricultural Sciences.

Sweden is a good example of a country providing high-quality solutions to barrier-free access, as this issue has been legally regulated there since the 1960s. An active approach to this issue is taken by the whole of society. For example, authorities, public institutions and private companies adopt policies on removing barriers. Any initiative related to this active approach is perceived very positively and is often used for promotion. Ordinary citizens are active as well, as they point out the existence of barriers and ask for their removal. The result of this society-wide activity has been the adoption of a law which considers the inaccessibility of public spaces as discrimination with all its consequences. Confirmation of this active and correct approach lies in the fact that before the regulations are adopted, there is extensive verification of the proposed measures, in the form of practical studies with the participation of people with various limitations. The result is then a proposal of an appropriate solution that takes account of the needs of all these people. Sweden also has various provisions in the building code which require modifications to existing public buildings and spaces leading to barrier-free access. The guarantor of the construction modifications, including their barrier-free solutions, is a state authority which also enforces the related legislation. The Swedish capital, Stockholm, strives to be recognized as the most accessible capital in the world. It is clear, therefore, that it takes measures in all areas of social life to make it available for people with reduced mobility and orientation, and to eliminate the prejudices within society concerning them (Antonovičová 2014).

This topic has already been looked into by researchers, such as Loučková and Fialová (2010), Jakubis and Jakubisová (2012), Jakubis (2013, 2014), Junek and Fialová (2012), Kotásková and Hrůza (2013), Jakubisová et al. (2015).

There are many among us who like a quiet corner of nature, and others who like to climb rocky peaks, descend into valleys and breathe fresh air on the banks of roaring torrents. However, there are also people who, due to their medical condition, are unable to do so and we have somehow omitted to give them the opportunity (Junek and Fialová 2012).

It is important to provide all people with impaired mobility with some compensation for their limited movement. Unless society as a whole is aware of this, they may become excluded from social life. Support for people in wheelchairs can help

them engage in various activities that will keep them active and prevent their social exclusion (Vítková 2006).

The proposals presented in this chapter are based on results of the projects financed by the Internal Grant Agency of Mendel University in Brno and project financed by the Visegrad Fund—Trails for disabled people in the V4 Countries.

1.2 Convention on the Rights of Persons with Disabilities

The UN Convention on the Rights of Persons with Disabilities (the Convention) is a very important document which deals with the rights of people with disabilities. Article 30 of the Convention, entitled "Participation in cultural life, recreation, leisure and sport", states that people with disabilities have the right to take part in cultural life, sport and recreational activities and tourism equally to others. Through physical activity, they improve their physical condition and mental health, as well as endurance and courage. In order to fulfil one of the objectives of the Convention, all spaces (both architectural and outdoors) should be wheelchair accessible, including tourist trails in the countryside. In the concept of these proposals, it is also very important to remove barriers to communication, bearing in mind that they are most limiting for people with hearing disabilities. In the practical management of removing barriers to accessibility of environments, products, information and services, it is necessary to implement many systemic measures, which should be then translated into legislative regulations and control mechanisms, such as: inclusion of principles of universal accessibility into national programs; adoption of control mechanisms for compliance with accessibility for all; promotion of and education in issues of accessibility and universal design; and support for related research.

1.3 Universal Design and Disabled People

In the concept of universal design for barrier-free access, it is important to know the needs of the people and conditions of the environment in which the individual person will move (e.g. wheelchair users, mothers with strollers, visually impaired pedestrians). In its implementation, the following principles are of importance: flexibility in use, simple and intuitive use, perceptible information. We can use these seven "Principles of Universal Design" to evaluate existing designs, not only in architectural built environments but also in proposals for wheelchair access to facilities in the natural landscape (thus in fact in any environment): size and space for approach and use (appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility), flexibility in use (the design accommodates a wide range of individual preferences and abilities), equitable use (the design is useful and marketable to people with diverse abilities), tolerance for error (the design minimizes hazards and the adverse consequences of accidental or

unintended actions), simple and intuitive use (use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level), low physical effort (the design can be used efficiently and comfortably and with a minimum of fatigue), perceptible information (the design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities). (https://www.thefreelibrary.com/Segs4Vets+making+mobility+accessiblea0179736624), North Carolina State University.

1.4 Requirements for Wheelchair Accessibility in Slovakia

Legislation on designing the Forest Transportation Network in Slovakia and associated legal standards are: STN 73 6101 Design of Roads and Motorways; STN 73 6110 Design of Local Roads; STN 73 6108 Forest Transportation Network; TP 10/2011 Technical Conditions—Design of debarrierization measures for persons with reduced mobility and orientation on roads, MDVRR SR: 2011; Decree of the Ministry for Home Affairs (MV) of the Slovak Republic No. 9/2009 Coll. implementing the Law on Road Traffic and amending and supplementing certain other laws, as amended; ResAP (2007)3: Resolution ResAP (2007)3 "Achieving full participation through Universal Design"; Decree of the Ministry for the Environment (MŽP) of the Slovak Republic No. 532/2002 Coll. specifying details of general technical requirements for construction and general technical requirements for structures utilized by persons with limited movement and orientation abilities; Law No. 317/2010 Coll. ratifying the UN Convention on the Rights of Persons with Disabilities; Communication from the Ministry for Foreign Affairs (MZV) of the Slovak Republic No. 317/2010 Convention on the Rights of Persons with Disabilities.

The research conducted focused on the preparation of materials concerning the building regulations in Slovakia. Universal design for implementation of barrier-free hiking trails (hereinafter the "BHT") in forest areas of the Slovak Republic recommends the following principles: unobstructed width of the BHT should be at least 1800 mm; it may be narrowed to a width of 900 mm only where justified, for example when terrain demands or technical equipment is installed; the longitudinal slope of a BHT section should be 1:21 (4.8%) at most and any section with such slope should not be longer than 20 m; if it is longer, it must be interrupted by a flat terrain with a relaxing bench; if the longitudinal slope of a BHT section exceeds the recommended value, it must be designed as a ramp equipped with handrails in compliance with construction regulations; the transverse slope of the BHT may be 1:50 (2%) at most; head clearance must be at least 2200 mm; the BHT surface must be even and hardened to be usable for a person with a wheelchair, walking aids, stroller and similar; if the BHT surface is made of a metal grid, the maximum size of the grid holes must be 20 mm × 20 mm; if the BHT surface is made of balks, they must be placed transversely to the direction of movement and the spaces between them may not be wider than 10 mm; if the BHT surface is made of natural stone tiles, the spaces must not be wider than 10 mm; naturally, the BHT surface must

be non-slip; BHT sections where a risk of falling is imminent must have a solid sidewall with filler at a height from 100 to 1100 mm; any bridge or footbridge on the BHT with a height up to than 500 mm above the ground must have an elevated rim on both edges up to a height of 100 mm or a guide rail at a height of 300 mm; a bridge or footbridge on the BHT with a height over 500 mm above the ground must have an unobstructed width of at least 900 mm; solid sidewalls with filler must be placed on both edges of the bridge at a height from 100 to 1100 mm; rest areas must be placed along the BHT (the recommendation is one rest area after per 200 m) outside the main course of the route, with benches and area for parking wheelchairs or strollers; benches for a rest must have backrests and armrests; there must be a hardened surface beside the bench to park a wheelchair or a stroller; multi-sensory means must be used for the information and orientation systems of the BHT (e.g. relief maps, plans, labels with inscriptions); there should be wheelchair-accessible toilets along the hiking trail. Wheelchair-accessible hiking trails in open countryside are designed for locations with favourable terrain and moderate slopes. They should be formed as a closed circuit with various lengths of routes, to provide a variety of choice and suit the demands of various users. Their design is related to the current legislation. These trails are usually not designated for one type of movement or user only—they can be used by others, for example cyclists.

1.5 Requirements for Wheelchair Accessibility in the Czech Republic

Decree No. 398/2009 on general technical requirements ensuring barrier-free use of buildings stipulates the obligation to propose adjustments in order to facilitate independent movement of persons with reduced mobility.

For passage, a wheelchair user needs a path width of 900 mm. However, where the wheelchair user needs to pass by a pedestrian or where turn, a width of 1500 mm is necessary. In the case when two people in wheelchairs need to pass by each other, a width of 1800 mm must be provided. The minimum space for turning a wheelchair by 90° to 180° is a rectangle sized 1200 mm × 1500 mm. The minimum handling space required for turning the wheelchair in different directions in angles greater than 180° is a circular area with 1500 mm in diameter (Fig. 1.2).

Therefore, pavements and hiking trails must be at least 1500 mm wide, ideally 2000 mm. Obstacles on the path, such as benches, information boards and trees must be placed so that the area for walking along them is at least 1500 mm wide. In justifiable cases, these can be placed so that the walking area is narrowed to 900 mm, but only locally.

The following general requirements must be met for barrier-free use by people with reduced mobility: the maximum elevation of a step a person in a wheelchair can overcome is 20 mm; the maximum longitudinal gradient of the path must be 1:12 (8.33%), or 1:8 (12.5%) on ramps not longer than 3 m; the maximum transverse

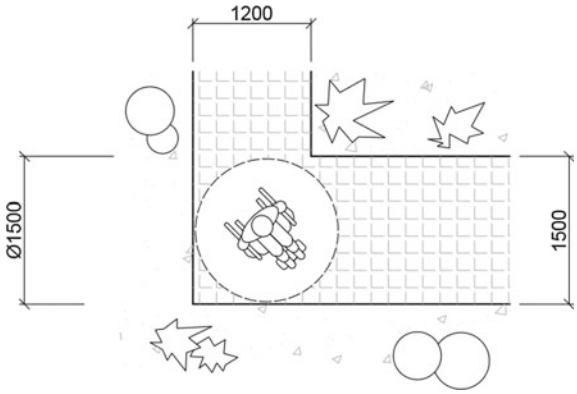

Fig. 1.2 Minimum handling space required for wheelchair turning (*Prepared by* Kotásková)

Fig. 1.3 Stairs and ramp leading to a pier which serves as a boat transport stop (*Photo* Kotásková 2015)

gradient should not exceed 1:50 (2%); fat bridge structures, the gradient must not exceed 1:40 (2.5%) with a minimum width of 900 mm. At gradients greater than 1:6, for example at the ends of a bridge, the wheelchair user might fall forward from the wheelchair. When going up, there is a real risk of the wheelchair toppling backwards. The wheelchair user cannot ride up a steep ramp without outside help (Filipiová 2002).

It is advisable to design different measures and solutions together at a single point on the path for various groups to overcome barriers. For example, to overcome a step in the terrain, people with reduced mobility might make use of a ramp with a smaller incline, cyclists might use a ramp with a steeper incline, and the others might use stairs (Fig. 1.3).

1.6 Proposing Trails and Viewpoints

Roads as well as hiking trails can be proposed near water bodies or rivers in some areas. The advantage of areas along rivers is mostly their flat terrain, so the paths in the vicinity usually have minimum inclinations. It is not necessary for the whole trail to run in the vicinity of water. It is advisable to design closed circuits or create a link to a network of trails which will enable shortening or lengthening of the trail. It is desirable to place viewpoints and relaxation points with comfortable benches along the trails. They need to be placed so that free passage of min. 1500 mm remains at any point on the trail, at best by creating lay-bys (see Fig. 1.4).

If there is a section with a longitudinal slope greater than 1:20 (5.0%) and longer than 200 m, it should have relaxation points with longitudinal and transverse slopes of not more than 1:50 (2.0%). When implementing these relaxation points, space needs to be left for a wheelchair or a stroller to be parked next to the bench or table (Fig. 1.5).

It is often not required to provide direct access to water; only a viewpoint in close proximity to the bank can be designed for the needs of the wheelchair user. The banks must be reinforced, mostly with simple vegetation adjustments.

The most important forest-type groups correspond to the structure of riparian stands based on the systematic division proposed by Mezera (1956). Non-autochthonous, non-indigenous, introduced, exotic and fruit species should be eliminated. Within riparian stands the most frequently used species are willow (*Salix*), alder (*Alnus*), elm (*Ulmus*), maple (*Acer*), ash (*Fraxinus*) and poplar (*Populus*). With respect to shrubs, the most frequent ones are in particular dogwood (*Corn*us), shrub willow (*Salix*), buckthorn (*Frangula*), hawthorn (*Crataegus*) and spindle tree (*Euonymus*). Accompanying stands can be made up of maple (*Acer*), ash (*Fraxinus*), lime (*Tilia*), elm (*Ulmus*), hornbeam (*Carpinus*), English oak (*Quercus robur*); disseminated mazzard (*Cerasus avium*), birch (*Betula*) or crane (*Sorbus*); the undergrowth may consist, for instance, of honeysuckle (*Lonicera*), hazelnut tree (*Corylus*) or privet (*Ligustrum*) (Šlezingr and Lichtneger 2011). The example of the riparian stand from the Czech Republic can be seen in the Fig. 1.6.

However, some places, particularly around water bodies, have significantly damaged banks, where erosion walls are formed and the soil is washed away. At these places, landslides are possible and so the viewpoint is dangerous.

Biotechnical revetment is one of the most suitable types of bank stabilization. Its technical element is placed in the most stressed part of the bank, and the vegetation elements are used in the less stressed parts (wave run-up zone). The elements overlap. Possible wooden stabilization structures are fences made from pole timber (Fig. 1.7), single- or multi-line woven fences, fascine and fascine-gravel cylinders, vegetated cabins, or vegetated flat bands of rubble masonry. Technical stabilization methods can also be used, e.g. stone used at the bottom of slopes, paving, stone rip-rap, prefabricated revetment, concrete or reinforced concrete retaining walls, or gabions (Ondrejka et al. 2013a).

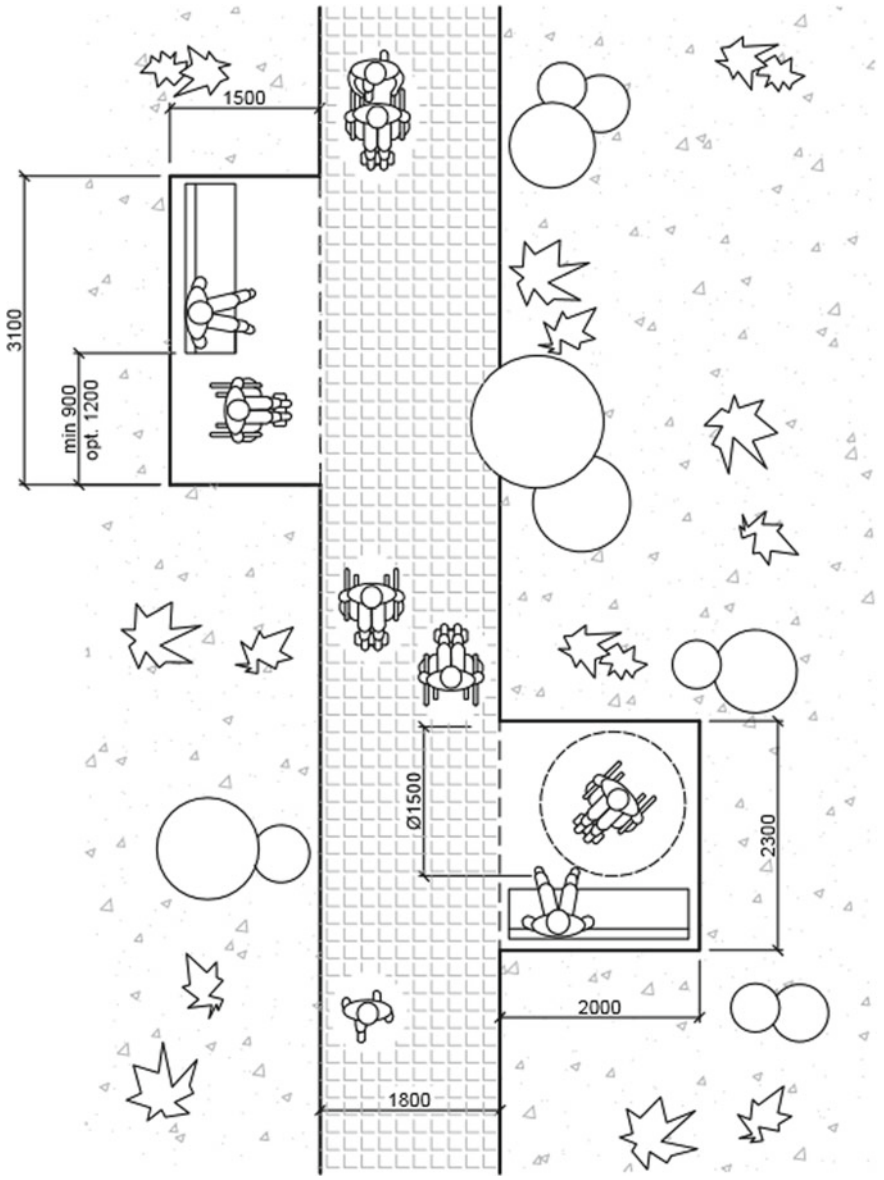

Fig. 1.4 Examples of the design of relaxation points (*Prepared by* Kotásková)

It is generally assessed that the most suitable type of revetment is a well-founded stabilization made of quarry stone of the required size together with stone rip-rap or rip-rap vegetated with willow cuttings at the bottom of the slope, and then grass cover and bank-side trees at the top of the slope (Fig. 1.8) (Šlezingr 2004).

Fig. 1.5 Example of an implemented relaxation point for every kind of person, including wheelchair users (*Photo* Kotásková)

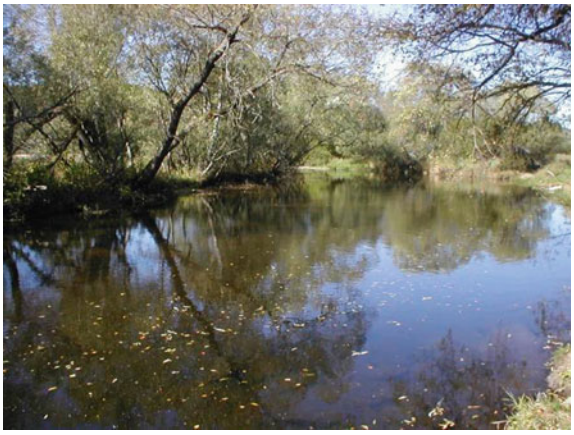

Fig. 1.6 Natural vegetation on the riverbank (*Photo* Šlezingr)

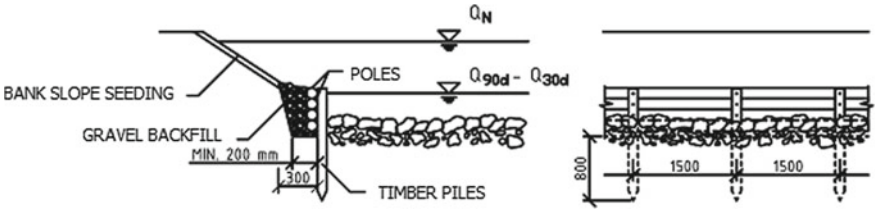

Fig. 1.7 Pole timber fences (*Prepared by* Kotásková)

The gabion is a very suitable stabilization element (Fig. 1.9) as well as other popular wire-stone structures, e.g. wire baskets filled with quarry stone. Gabions copy small uneven places in the terrain and water can flow through them. Stone is a natural material, and thus, it suits the landscape better than prefabricated concrete

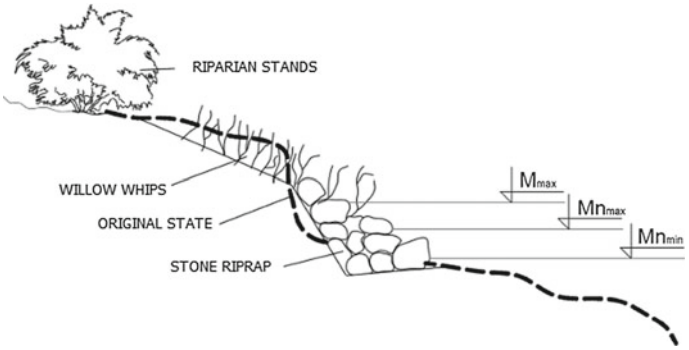

Fig. 1.8 Vegetated stone rip-rap (*Prepared by* Šlezingr)

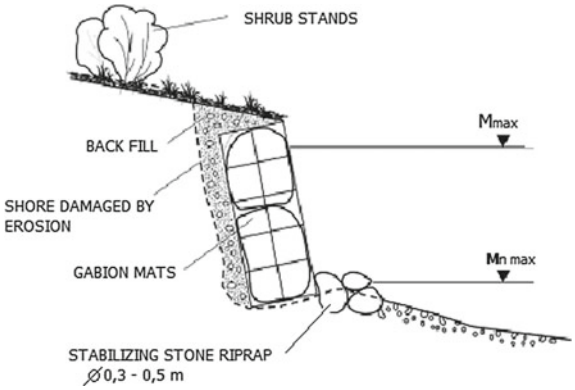

Fig. 1.9 Placement of gabion for bank revetment (*Prepared by* Šlezingr)

panels or vegetation blocks, especially when vegetation begins growing through the stone (Ondrejka et al. 2013b).

Relaxation points and viewpoints, or fishing spots, can be made using a paved area or wooden footbridges (Fig. 1.10). Additionally, they can be placed above the body of water on a bridge structure (Fig. 1.11). Even large-span wooden bridges for high loads are possible when sufficiently strong load-bearing materials are used; especially useful in this case is pasted laminated wood. Wood is able to sustain short-term overloading without adverse effects. Thanks to the development of connecting elements, it is possible to design modern and highly aesthetical platforms and bridges (Kotásková and Hrůza 2013).

Ideally, the path surface should suitably fit in the natural environment; however, it is not suitable to use unpaved surfaces or surfaces paved with a non-cemented material for wheelchair users, as these surfaces become unusable, especially after spring thaw or long-lasting rains. Therefore, the surface of a path which leads along a

Fig. 1.10 Making the surroundings of a watercourse accessible for wheelchair users—Finland (*Photo* Fialová)

Fig. 1.11 Example of making a watercourse and viewpoints accessible for wheelchair users (a section of the barrier can be opened) in Finland (*Photo* Fialová)

Fig. 1.12 Path drainage—barrier for wheelchair users on an otherwise accessible trail (*Photo* Kotásková)

stream must be paved with either close-to-natural means, bitumen or concrete, based on the character of the surroundings and the frequency of use.

The only recommendable non-cemented surface is a layer of mechanically reinforced aggregate with maximum fraction size of 32 mm.

Mechanically reinforced aggregate can be a suitable surface, provided that the finest fraction size is used when building the road and correct technological procedures are followed. This type of surface is mainly recommended for public spaces and parks due to its properties, which are in particular strength and durability. However, it should be noted that this surface holds water, and when it is used it must have proper drainage (Calkins 2009; Axelson and Chesney 1999).

Other types of non-cemented layers with maximum fraction size of 63 mm are not recommendable with regard to the width of tires and size of the wheels of non-motorized means of transport (Hrůza 2015).

Additionally, the surface can be paved with compact asphalt layers. It is also possible to use tiles with minimal joints (interlocking concrete pavers), though the material might not always fit in with the environmental character.

Asphalt surfaces seem to be the most suitable coverings, as the surface is even, the risk of slipping is reduced, movement is comfortable, and these surfaces are also highly functional and durable. The highest quality asphalt covers commonly used are coated aggregate, asphalt concrete or asphalt blanket. Pavements can be made from cast asphalt with concrete underlay. Currently, the most common cover for paths with asphalt pavement is penetration macadam. However, for this purpose it is probably the least suitable one of all the bituminous covers. In the structure of this pavement aggregate of rough fractions (0–32, or up to 64 mm) is used, which leads to a rough surface due to the more pronounced structure of the material (Juško 2015).

The path must not include any barriers such as drainage or soakaways reinforced with stone (see Fig. 1.12).

A lawn, especially if it is well maintained, is very well perceived as a natural surface. However, it must be remembered that wheelchair users need to exert much

Fig. 1.13 Inappropriate design of pavement with a timber surface (*Photo* Kotásková)

more effort on grass than when moving on a totally smooth surface, and a grass surface can also be damaged by the wheels of wheelchairs. This damage can be prevented by the use of grass stabilization plastic mats (Axelson and Chesney 1999; Calkins 2009).

Timber surfaces are suitable for paths, provided that the timber used is of high quality, strong and well-treated, and larger spaces are left in the construction because the volume of timber can change depending on the air humidity. If these requirements are not complied with, the use of this surface can cause considerable difficulties. Woodchips are not an appropriate surface for people with reduced mobility in general (Axelson and Chesney 1999).

When timber is used, its long life should be ensured by means of constructional protection. Timber should not rest directly on the ground. This causes degradation due to increased humidity and thus also moisture. Moisture in timber brings about volume changes, so it is not appropriate to fill the spaces between the timber elements with concrete, as seen in Fig. 1.13.

Wooden corduroy walkways are used in waterlogged or otherwise inaccessible areas. The walkable area is placed between longitudinal beams and consists of prisms—longitudinally cut logs or planks attached to the beams with nails. The joints between the individual elements should be at least 1 cm so that water can flow away from the surface. The wooden elements must not be placed parallel to the demanded movement as the longitudinal joints and potential unevenness of the individual wooden components could form traps for wheelchair users (Fig. 1.14). Additionally, there should be guiding rails taller than 60 mm to prevent potential falling off the path in the case of swerving (Fig. 1.15). A similar design can be used for the viewpoints and wooden piers.

No decree or regulation covers this issue, and there are no binding rules. The Czech Fishing Union made an attempt to cover this gap and published recommendations concerning the fishing spots suitable for disabled fishers on its website.

According to the recommendations, a place suitable for disabled fishers should bear the symbol of a disabled fisherman and should be included in the list registered by the Czech Fishing Union. However, the symbol does not mean that the place is reserved for disabled anglers. It only has informative character and

Fig. 1.14 Unsuitable design of a corduroy road (*Photo* Kotásková)

Fig. 1.15 Suitable surface of a corduroy trail for wheelchair users (*Photo* Fialová)

points out the suitable access, parking and fishing places for people with physical limitations (https://www.rybsvaz.cz/?page=reviry%2Fztp%2Fztp&lang=cz&typ=mpr&id_svaz=&moznosti_rybolovu_prehled=ztp#zalozka).

The places suitable for fishing are those with good access to water in a wheelchair (preferably a paved access road without mud, sand, larger bumps or other complications), where the wheelchair can stop in a suitable flat place on the bank, and the fish can be caught and taken out using a common landing net without the assistance of another person.

With regard to the recreational use of places for bathing by people with reduced mobility, it is essential that the beaches and approaches are adapted for their easy access (Fig. 1.16).

The parameters of public beaches and water access are not defined in any binding regulation in the Czech Republic. There are mainly grassy and sandy beaches in the Czech Republic. However, movement by a disabled person on a sandy or grassy

Fig. 1.16 A suitable access road near a water body: the asphalt surface is laid on a base made from mechanically reinforced aggregate which is well compacted (*Photo* Kotásková)

Fig. 1.17 An example of a lifting device to move wheelchair users into the water (*Photo* by ALTECH, spol. s r.o.; http://www.altech.cz/produkty/bazenovy-zvedak/bazenovy-zvedak-delfin/)

beach is difficult. Additionally, water access provided by means of steps with rails can only be used by some of the disabled. Another option to get out of the wheelchair into water involves using a suitable lifting device placed on a pier (wooden platform) above the water surface (see Fig. 1.17).

The device must be characterized by simple handling and easy fitting to the construction of the pier, or the bottom. The device, which is currently manufactured and used in swimming pools, does not require installation under water, power supply or motor; only pressure from standard water supply is needed. The connection of the water supply with a valve located on the jack is effected using a hose with an internal

Fig. 1.18 Board on a nature trail; positioned at a suitable height for wheelchair users—Scotland (*Photo* Fialová)

diameter of 10 mm. This device can be used in places where there is the mains water supply (0.4 MPa). The lifting device is operated using a lever. A special safety lock secures the seat until the user is comfortably seated. The movement of the seat is provided by water pressure, which releases the safety lock in the upper position of the jack. The seat is made of polypropylene and can be loaded with a weight up to 110 kg. On customer request, the pool lift comes with a clamping belt for maximum safety and comfort. The jack is commonly installed in swimming pools with a minimum depth of 1100 mm. Wheelchair users can use it for all water sports and activities, if it is located near water reservoirs or other water bodies where swimming is possible (http://www.altech.cz/produkty/bazenovy-zvedak/bazenovy-zvedak-delfin/).

Around rivers and water bodies, there can be trails designed as educational with information boards (Fig. 1.18). For people in wheelchairs, appropriate access and sufficient space in front of the information board should be provided to allow turning of the wheelchair. The information board should be of suitable height corresponding to the eye-height of people in wheelchairs. The centre of the information board should not be higher than 120 cm above the ground (Lundell et al. 2005).

Technical solutions of proposal trails in urban areas (Figs. 1.19, 1.20 and 1.21) are different in comparison with proposals for the countryside.

As an example of differences in barrier-free proposals near the river within a town, we present the EUROVEA waterfront in Bratislava (Fig. 1.22) and the waterfront in Lyon (Fig. 1.23). The difference in the examples of proposals and in approaches to creation of the waterfront with barrier-free access is evident. Why is the issue of barrier-free access or universal principles so important? Because the creation of a thoughtful environment must be characterized by tolerance for human diversity, for weaker and older people, and for all users if possible. In areas for recreation with landscape protection, it is important to create a barrier-free environment, paying respect to cultural heritage, natural attractions, places with a view of the countryside, rivers, birdwatching, wildlife, plants and trees. People with disability have either no possibility of access or limited access to tourism.

Fig. 1.19 View of Horné Lánice Park near the River Hron in Zvolen (Slovakia) with the possibility of leisure activities "for All" (*Photo* Jakubisová)

Fig. 1.20 Hiking trail near the River Hron in Zvolen (Slovakia), suitable for wheelchairs. In the background, an artificial canal built for water slalom-kayaking (*Photo* Jakubisová)

Fig. 1.21 Detail of arch bridge with wheelchair access over a tributary of the River Hron (Kováčovský potok) on hiking path in Zvolen, Slovakia (*Photo* Jakubisová)

1.7 Example of the Study—Počúvadlo (Slovakia)

Here is an example (Fig. 1.24) of other possibilities for movement by wheelchair users around bodies of water such as lakes or water reservoirs suitable for recreation and tourism in Slovakia. The natural conditions of trails for wheelchair users are specific, and proposals should be close to being formally standardized. Interventions in the

Fig. 1.22 Bratislava waterfront (*Photo* Jakubisová)

Fig. 1.23 Lyon waterfront (*Photo* Jakubisová)

countryside (e.g. in a Protected Landscape Area) are subject to strict laws and may be allowed only in exceptional cases. We therefore propose parameters and conditions different from the standards stipulated for architectural design of buildings. For these reasons, we suggest attractive places for movement in a wheelchair that do not need any major intervention or changes in the environment and are suitable for tourist and recreational activities for wheelchairs. The protected areas may still be in the "pleasure periphery", or they are destinations for sustainable tourism activities.

Information about the technical parameters (Table 1.1; Fig. 1.25) and access including the localization of these territories is very important for disabled people (Table 1.2).

Fig. 1.24 Hiking trail for disabled people near Počúvadlo reservoir in the Štiavnické vrchy Protected Landscape Area, Slovakia (UNESCO) (*Photo* Jakubisová)

Table 1.1 Basic data about Počúvadlo hiking trail for wheelchair people (Jakubisová 2014)

Summary of the characteristics of the route for wheelchair people	Data
Total length of the route	1.82 km
Maximum longitudinal slope between stations S11–S12	12.08%
The maximum cross slope on the road	3.00%
Max. height/depth of barriers on the road	0.08 m
Estimated time of the presentation on individual stops (in hours)	¼
Estimated speed of wheelchair users (km/hours)	1 km/0.6
Estimated time of the route without stopping (in hours)	1.09

Explanatory notes For overcoming obstacles for wheelchair users is important: maximum longitudinal slope does not exceed the length 150 m on the trail; cross slope of the route is max. 2%; surface unevenness not exceed the height and depth of 8 cm

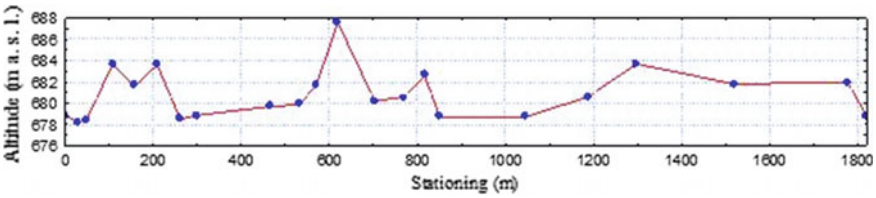

Fig. 1.25 Longitudinal profile of Počúvadlo—technical parameters of hiking trail for wheelchair users (*Source* Jakubisová 2014)

1.8 Example of the Study—Brno Dam Area (Czech Republic)

As the model area, the Brno Reservoir was chosen. It is one of the most significant water reservoirs in the Morava River drainage basin. Brno Reservoir is located in the Podkomorský forest north-west of Brno city, on the River Svratka. It is one

Table 1.2 Localization of territory Štiavnické vrchy Protected Landscape Area in Slovakia

Country	Slovakia
Geographic region	Banská Bystrica
Governing body	Štiavnické vrchy Protected Landscape Area Administration in Banská Štiavnica
Location	Central Slovakia
Coordinates	N48° 24′ 42″ E18° 52′ 21″
Established	22 September 1979
Area	77,630 ha
Water reservoir	Počúvadlo
Altitude	550 m a.s.l.
Area	12.3 ha
Coordinates	N48° 21′ 59″ E18° 50′ 05″

Fig. 1.26 Barrier-free toilets and changing rooms (*Photo* Kotásková)

of the water management structures whose history began before the Second World War. The dam was brought into operation in 1940. The main purpose for the dam construction was to ensure sufficient amounts of irrigation and drinking water for the Brno agglomeration, and the next purpose was flood protection. From the beginning, it was planned well as a source of energy and recreation. A feature unique in Europe is the public transport provided by electrically driven boats.

The water capacity is 21 million m^3, and the surface elevation is 229.08 m above sea level. The reservoir occupies an area of about 270 hectares, has a length of 10 km and extends to the town of Veverská Bitýška. The maximum reservoir depth is 23.5 m (Šlezingr 1998).

We can see barrier-free access in some parts around the Brno Reservoir. Reinforced roads, for example in Kozí Horka, and barrier-free toilets and changing rooms have been constructed (Fig. 1.26).

Another good example of barrier-free access is the construction of new barrier-free boat transport stops. Embarking and disembarking from the boat is done by means of piers. The barrier-free regulation imposes no requirements on the pier's technical

Fig. 1.27 Boat transport stop Kozí Horka—an example of good solution for the movement of the disabled (*Photo* Kotásková)

implementation; it only deals with the parameters of wheelchair-accessible ramps. These parameters should be analogically used when designing barrier-free piers, with respect to the specific local conditions. In general, the barrier-free decree emphasizes the use of appropriate surface, sloping and railing of the ramp, which should be followed even in the case of a pier. Naturally, a smooth barrier-free transition from the pier to the following road must be provided too. The Brno Reservoir has a newly implemented barrier-free boat transport stop at Kozí Horka as shown in Fig. 1.27. There was a bad access path to the old stop where people had to take uncomfortable steps.

The new solution is an extended pier with a pathway: the pier construction is fixed, and the pathway is taken away when the boating season finishes. It is a steel structure with a grid and non-slip treatment. The grid appears to be a very suitable surface. Water does not remain there and so the surface is not slippery even after rain. The pier is equipped with double-sided railings. There is a smooth transition to the path of mechanically reinforced aggregate, leading to the beach and the parking lot (see Fig. 1.28).

Other options for barrier-free access at the Brno Reservoir are currently being planned. So far the plans for possible use of the public beach with access to water using lifting equipment have not been completed.

There are several places used as public beaches around the Brno Reservoir. There is usually a grassy surface, and the beach boundaries are not precisely defined. Access to water has a natural character and is very steep in many places. Some locations have reinforced banks. In the framework of a project implemented in the previous period by the Morava River Basin Company, banks with a length of 590 m were reinforced at the sites Rakovecká zátoka and Kozí Horka, with grass stabilization concrete panels and in one place quarried stone. Currently, there are quite a lot of new access paths to the water. These paths usually use steps with railings on one or both sides. They are generally 1.5 m wide. Some of them in the middle of the site

Fig. 1.28 Smooth transition from the boat-stop pier to the path made of mechanically reinforced aggregate (*Photo* Kotásková)

Fig. 1.29 Concrete steps providing access to water (*Photo* Kotásková)

near a newly rebuilt fenced playground have a width of 3.5 m. Monolithic reinforced concrete was used for their construction as shown in Fig. 1.29.

A pier with a lifting device or other apparatus enabling wheelchair users to swim in the water is missing from the whole area of the Brno Reservoir.

There are places where disabled anglers could go fishing, but not all of them meet the conditions for their safety. The reasons are, e.g., steep slopes of the banks, access roads with bumps, or rocky or loamy–sandy banks.

1.9 Conclusion

This chapter lists the parameters that have to be respected for a universal design of the environment around water bodies or near rivers. This means designing for all, especially barrier-free access. As the examples show, it is necessary to design not

only a suitable surface and road slope, but also places for relaxation or viewpoints. It is also possible to create suitable barrier-free water access points or fishing spots. Naturally, when designing such a place, parking spaces as well as barrier-free toilets at a sensible distance are a necessity.

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